REMARKS

Claims 1 and 3 remain for consideration in this application. Claims 1 and 3 have not been amended in this paper. Reconsideration of the rejection of claims 1 and 3 is respectfully requested.

Claims 1 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Amstutz (USP 4,634,229) in view of Natsunaga (USP 5,548,423).

It is respectfully requested that the above rejection be withdrawn in view of the remarks and information provided below. The Office Action sets forth Responses to the applicants' arguments in the previous response dated November 12, 2003. The Office Action's Responses are described, in essence, in bold letters below:

Amstutz discloses "the polarizers having absorption axes which are orthogonal to each other" in column 5, lines 4-8, and with reference to claim 1 of the present invention, Fig. 1 in Amstutz shows a liquid crystal display device including, for example, a twisted angle of $\Phi = 190°$, a crossed absorption axes angle of a pair of polarizing plates being $\Psi = 90°$, an angle of $P1 = 45°$ formed of an absorption axis of an upper polarizing plate and a direction of intermediate liquid crystal molecules, and an angle of $P2 = 90°$ formed of an absorption axis of a lower polarizing plate and a direction of intermediate liquid crystal molecules.

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A) As to the comment above, the features set forth in the Office Action are not, in fact, disclosed in **Amstutz**, column 5, lines 4-8. **Exhibit 1** is enclosed for easier understanding. **Exhibit 1 (1/2)** is an enlarged copy of column 4, line 62 to column 5, line 8 of **Amstutz**. To show the relationship with Fig. 4 in **Exhibit 1 (2/2)**, the features from column 5, lines 4-8 are clearly labeled by adding the reference letters **A - E** for "axis" and each "direction". **Exhibit 1 (2/2)** shows Fig. 4 of Amstutz in which an explanation for each part and direction is added, as well as reference letters **A - E**.

As seen from the above, the part the Office Action referred to is an explanation of structure in Fig. 4, and as recited in last four lines, "The direction **[B,C]** of vibration of the polarizers 10 and 11 are <u>indicated by arrows which lie in the corresponding planes perpendicular to the axis [A] of the cell</u>."

Accordingly, there is no recitation of <u>absorption axes of polarizing plates 10, 11 being orthogonal to each other.</u> This is not shown in the above description from the Amstutz specification. Further, Figs. 4 and 5 do not disclose the absorption axes of polarizing plates 10 and 11 as being orthogonal. Accordingly, since there is no disclosure in Amstutz that the absorption axes of the polarizing plates are orthogonal, claim 1 cannot be obvious over Amstutz and Natsunaga.

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B) Furthermore, it is clear from the above that there is no recitation in **Amstutz** to suggest each value of the angles can be as stated in the Office Action, i.e. $\Phi = 190°$, $\Psi = 90°$, $P1 = 45°$, $P2 = 90°$. There is simply no basis in Amstutz to arrive at these values. In fact, Table 1 of Exhibit 2 (described in detail below) sets forth the correct values arrived at for Amstutz if $\Phi = 190°$.

C) Only the present invention, as set forth in claim **1**, discloses that when a twisted angle Φ is greater than 180° and less than or equal to 260°, a crossed absorption axes angle of pair of polarizing plates Ψ is 90° and angles of intermediate liquid crystal molecules and upper and lower polarizing plates P1, P2 are within a range of ±40° to ±50°. This is also clearly set forth in Table 1 of Exhibit 2 (described below).

D) Furthermore, the Office Action notes that "**Amstutz et al.** does not disclose the LCD can be driven by applying a voltage of 10 to 20V. However, **Natsunaga** (US 5,548,423) does disclose that a drive region can be in the range of VL (3 to 5V) to VM (30 to 40V) (figure 9). Therefore, such disclosed range in **Natsunaga** makes possible the claimed range of 10V to 20V overlapping ranges are at least obvious".

However, in a liquid crystal display being driven at 10 to 20V, contrast improves only in a mode with a crossed absorption axes angle Ψ being orthogonal and above-mentioned P1, P2 being within a range of ±40° to ±50°.

Furthermore, in the state where no voltage is applied, white display is performed by the birefringence of the liquid crystal, a voltage of 10 to 20 volts is applied to nullify the birefringence, and liquid crystal molecules are raised substantially perpendicular to the substrate in order to perform black display. Accordingly, in an opened state (white display) of the liquid crystal shutter according to claim 1, high transmittance by the birefringence peculiar to an STN liquid crystal device can be realized. On the other hand, in a closed state (black display), liquid crystal molecules are raised substantially perpendicular to the substrate and the birefringence is almost nullified, so that it becomes possible to provide a liquid crystal shutter with a high contrast, response time of several ms, and a high speed response time which is ten times faster than a conventional STN liquid crystal shutter.

The Office Action's second Response to applicants' previous response is, in essence, as follows:

2. A twisted angle in Amstutz is not limited to only 240° but in the range of 180° to 360°. Therefore, the twisted angle of 190° disclosed in Fig. 1 is also within the range claimed in the present application.

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The Office Action suggests that while Amstutz does not work for a twist angle of 240°, it may work for an angle of 190°. Attached as part of **Exhibit 2** is Table 1 showing more examples than the **Exhibit 2** of applicants' November 12, 2003 response. Current Exhibit 2 makes it clear that Amstutz does not meet the limitations of claim 1 throughout the claimed range. It is suggested in the Office Action that although the twist angle of 240° for Amstutz does not meet the limitations of claim 1, as clearly set forth in applicants' response of November 13, 2003, other ranges might fit. Table 1 of Exhibit 2 attached hereto, in fact, clearly shows that Amstutz does not disclose, nor suggest the features of claim 1 for the whole range. There are simply no ranges in which the LCD of Amstutz falls within the limitations of claim 1.

Table 1 compares the present invention to Amstutz. The present invention and it's calculated values are set forth in rows 1 and 2. The Example of Amstutz and modified examples of Amstutz 1-5 are set forth in the following rows. The Amstutz example and the modified examples of Amstutz 1-5 consider twisted angles from 190° to 270° (180° is close to 190° and would have substantially the same result). As clearly illustrated in Table 1 of Exhibit 2, neither the disclosed example of Amstutz (270°), nor any example in the other ranges (modified examples of Amstutz 1-5), discloses values that meet the limitations of claim 1. If the twisted angle (Φ) is within the range of claim 1 ($180° < \Phi \leq 260°$) then the crossed absorption axes angle of the pair of polarizing plates (Ψ) or the angles between the intermediate liquid crystal molecules and the absorption axes of the upper polarizing plate (P1) or the lower polarizing plate (P2) are <u>outside</u> of the range of claim

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1. In no case does the disclosed example of Amstutz (270°), nor any of the other calculated values (modified Amstutz), fall within the limitations of claim 1. Accordingly, claim 1 cannot be obvious over Amstutz, in view of Natsunaga, since even a combination of those two references does not disclose, or suggest, structure that falls within the range set forth in claim 1.

More specifically, in **Exhibit 2, Table 1** includes data in a case in which Φ is 190°, which is close to 180° as a modified example of the present invention in addition to a case in which Φ is 240° in an example of the present invention (**Table 1,** 1st and 2nd rows). **Exhibit 2** also contains a discussion on how to calculate angles β and γ in a case of Φ = 190°. Even when Φ is another value, β and γ can still be calculated in the same manner.

As to data regarding **Amstutz**, the case of Φ = 270° and Ψ = 90° is <u>not</u> disclosed as an example in **Amstutz**, but Table 1 provides this example as a modified example. Therefore, additionally included in **Table 1,** modified Amstutz 1 is for a case of Φ = 270° and Ψ = 90°, and also modified Amstutz 2-5 are for cases of Φ = 240° and Φ = 190°, (**Table 1**, 3rd to 8th rows). **Exhibit 2** also contains a discussion of how to calculate angles P1, P2, and Ψ in a case of Φ = 190°.

It is clear that in view of the data shown in **Table 1** proves that a twisted angle (Φ) in the range of 180° < Φ ≤ 260° and angles P1, P2 in the range of ±40° to ±50°, as required by claim 1 of the present application, neither the disclosed Amstutz, nor any modified example of **Amstutz** can form a crossed absorption axes angle of two polarizing plates at 90°.

Attached hereto is a declaration under 37 C.F.R 1.132 prepared by one of the inventors

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(Yasushi Kaneko) in the above-identified application. This declaration repeats some of and supports the conclusions set forth above, in addition to providing further details in some respects.

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CONCLUSION

In view of the above remarks and the attached information, including the declaration under 37 C.F.R. § 1.132, it is clear that Amstutz does not disclose orthogonal crossed absorption axes as suggested in the Office Action. Furthermore, it is clear that Amstutz does not disclose, nor suggest, the features set forth in claim 1. The above remarks, information and the declaration under 37 C.F.R. §1.132, do not raise a new issue. This response simply elaborates on the issues already discussed in Applicants' response dated November 12, 2003. Because Amstutz fails to disclose (or suggest) the requirements of claim 1 (with or without Natsunaga), claim 1 must be allowable over the cited references.

Accordingly, it is respectfully requested that the rejection of claim 1 (and claim 3, dependent therefrom) be withdrawn, and this case be passed to issue.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

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RESPONSE UNDER 37 C.F.R. §1.116 - EXPEDITED RESPONSE
By: **Yasushi KANEKO et al.**
Serial No. **08/981,654**

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 50-2866.

Respectfully submitted,
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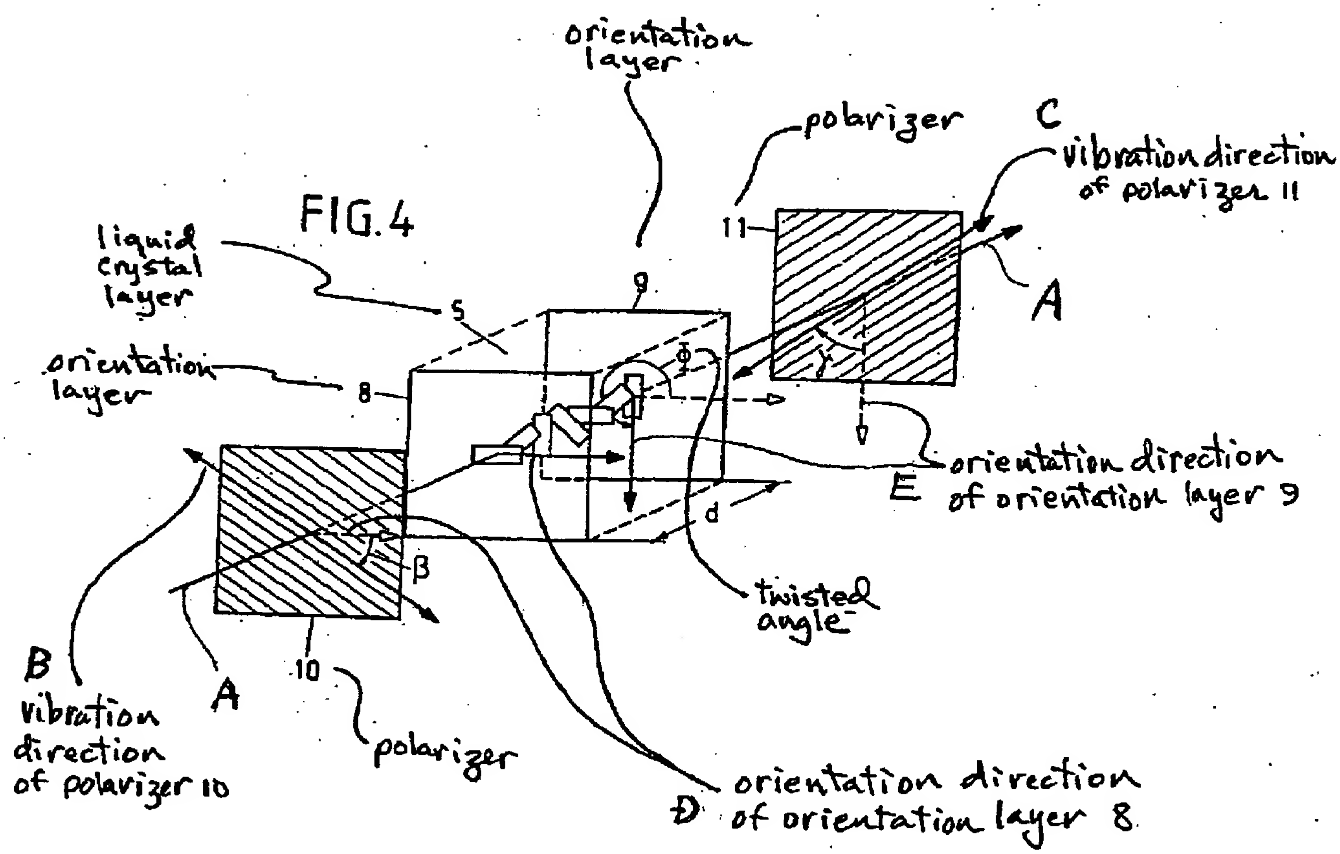
EXHIBIT 1

(column 4, line 62 - column 5 , line 8 in Amstutz et al.)

FIGS. 4 and 5 show exploded, perspective representations of the arrangement of the polarizers **10** and **11**, the orientation layers **8** and **9** as well as the liquid crystal layer **5** located between these layers. The total twist ϕ of the liquid crystal in the layer is made clear by a chain of liquid crystal molecules which are schematically represented by small rectangular platelets. Support plates, border and possible reflectors have been left out for sake of clarity. The elements of the cell are arranged along an axis A pointing along the propagation direction of the incident light. The direction B, C of vibration of the polarizers **10** and **11** as well as the orientation direction D, E of the orientation layers **8** and **9** are also indicated by arrows which (B,C,D,E) lie in the corresponding planes perpendicular to the above-mentioned axis A of the cell.

FIG. 4 of Amstutz et al.



RESPONSE UNDER 37 C.F.R. §1.116 - EXPEDITED RESPONSE
By: Yasushi KANEKO et al.
Serial No. 08/981,654

EXHIBIT 2

TABLE 1
Comparison between Present Invention and Amstutz

	Φ	Ψ	P1	P2	γ	β	γ + β	Meets Claim 1 Limitations
Example of present invention	240	90	−45	+45	105	75	180	Yes
Modified Example of present invention	190	90	−45	+45	130	50	180	Yes
Example of Amstutz	270	60	75	15	60	30	90	No
Modified Example of Amstutz 1	270	90	0	90	45	45	90	No
Modified Example of Amstutz 2	240	60	15	75	45	45	90	No
Modified Example of Amstutz 3	190	10	−50	140	45	45	90	No
Modified Example of Amstutz 4	190	90	−90	0	85	5	90	No
Modified Example of Amstutz 5	190	90	0	90	−5	95	90	No

Φ: twisted angle
Ψ: crossed absorption axes angle of a pair of polarizing plates
P1: angle of intermediate liquid crystal molecules and an absorption axis of upper polarizing plate
P2: angle of intermediate liquid crystal molecules and an absorption axis of lower polarizing plate
β: angle of upper liquid crystal molecules and absorption axis of upper polarizing plate
γ: angle of lower liquid crystal molecules and absorption axis of lower polarizing plate

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RESPONSE UNDER 37 C.F.R. §1.116 - EXPEDITED RESPONSE
By: **Yasushi KANEKO et al.**
Serial No. **08/981,654**

HOW TO CALCULATE DEGREE OF ANGLES

Present Invention (in a case of $\Phi = 190°$) : See FIG. A

1. Draw a horizontal axis (X axis) and a vertical axis (Y axis) on a paper. Draw axes of the upper orientation direction (upper LC) and lower orientation direction (lower LC) for a twisted angle ($\Phi = 190°$) so as to have the vertical axis being in the direction of the intermediate liquid crystal molecules.

2. Draw an absorption axis of a polarizing plate. Here, the absorption axes of an upper polarizing plate (upper PL) and a lower polarizing plate (lower PL) are positioned to have 45° difference respectively relative to the direction of the intermediate liquid crystal molecules ($P1 = -45°$, $P2 = 45°$) and to be orthogonal to each other ($\Psi = 90°$).

3. Measure angles (β) formed of the axis of the upper orientation direction (upper LC) and the absorption axes of the upper polarizing plates when it is viewed from the axis of the upper orientation direction. Here, the absorption axis of the upper polarizing plate (upper PL) viewed from the axis of the upper orientation direction (upper LC) forms an angle of 50° ($\beta = 50°$) counterclockwise.

4. Measure angles (γ) formed of the axis of the lower orientation direction (lower LC) and the absorption axes of the lower polarizing plates when it is viewed from the axis of the upper orientation direction. Here, the absorption axis of the lower polarizing plate (lower PL) viewed from the axis of the upper orientation direction forms an angle of 130° ($\gamma = 130°$) counterclockwise.

In other cases that angles satisfy $180° < \Phi \leq 260°$, e.g. a case of $\Phi = 240°$ in Table 1, γ and β can be calculated in the same manner as above.

Amstutz (in a case of $\Phi = 190°$) : See FIG. B

1. Draw a horizontal axis (X axis) and a vertical axis (Y axis) on a paper. Draw axes of the upper orientation direction (upper LC) and lower orientation direction (lower LC) for a twisted angle (Φ=190°) so as to have the vertical axis being in the direction of an intermediate liquid crystal molecules.

2. In Amstutz, an angle (β) formed of the axis of the upper orientation direction (upper LC) and an absorption axis of an upper polarizing plate (upper PL) when viewed from the axis of the upper orientation direction, and an angle (γ) formed of the axis of the lower

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orientation direction (lower LC) and an absorption axis of a lower polarizing plate (lower PL) when viewed from the axis of the upper orientation direction, are defined as $\gamma + \beta = 90°$ or $0°$. Therefore, the absorption axis of the upper polarizing plate (upper PL) and the absorption axis of the lower polarizing plate (lower PL) are drawn with $\gamma = 45°$ and $\beta = 45°$ being adopted, for example.

3. Measure an angle (P1) formed when the absorption axis of the upper polarizing plate (upper PL) is viewed from the direction of intermediate liquid crystal molecules. In this case, P1 = −50°. Similarly, read an angle (P2) formed when the absorption axis of the lower polarizing plate (lower PL) is viewed from the direction of the intermediate liquid crystal molecules. In this case, P2 = 140°.

4. Measure an angle (Ψ) formed of the absorption axis of the upper polarizing plate (upper PL) and the absorption axis of the lower polarizing plate (lower PL). In this case, $\Psi = 10°$. $\Psi = |P1 - P2| = |-50 - 140| = 190° = 180° + 10° = 10°$.

In case of $\gamma = 85°$, $\beta = 5°$ or $\gamma = -5°$, $\beta = 95°$, Ψ will be 90°, and P1 and P2 are 0° or ±90°. It means it is difficult to make the present invention condition ($\Psi = 90°$, P1 = ±40° ~ ±50°, P2 = ±40° ~ ±50°) from Amstutz condition ($\Upsilon + \beta = 90°$).

In other cases that angles satisfy $180° < \Phi \leq 360°$, e.g. cases of $\Phi = 240°$ and $\Phi = 270°$ in Table 1, P1, P2, and Ψ can be calculated in the same manner as above.

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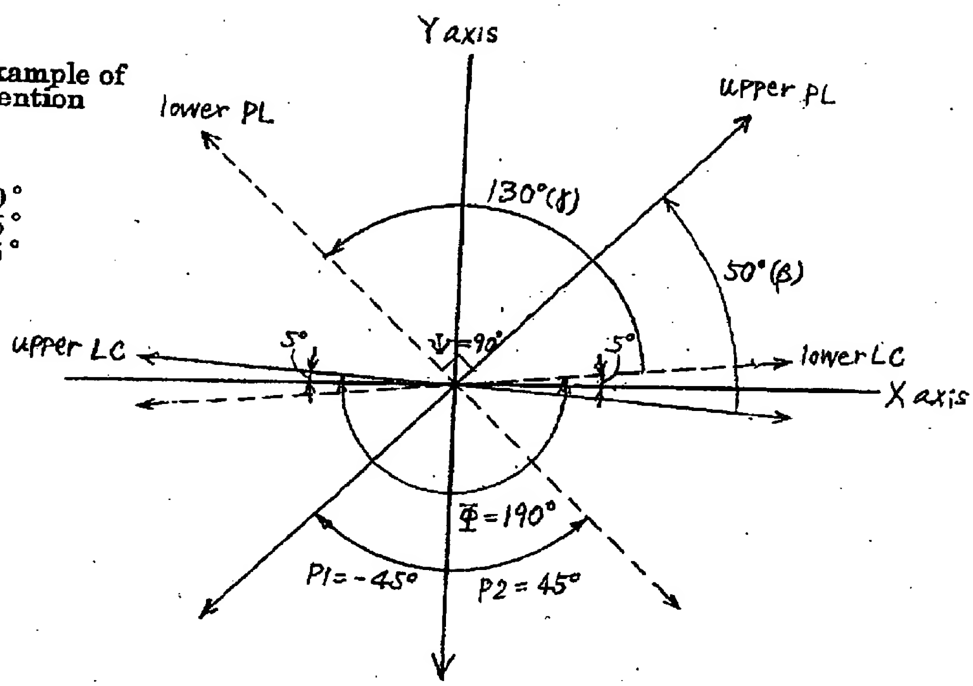
FIG. A

Modified Example of Present invention

condition

$\Phi = 190°$
$P1 = 45°$
$P2 = 45°$



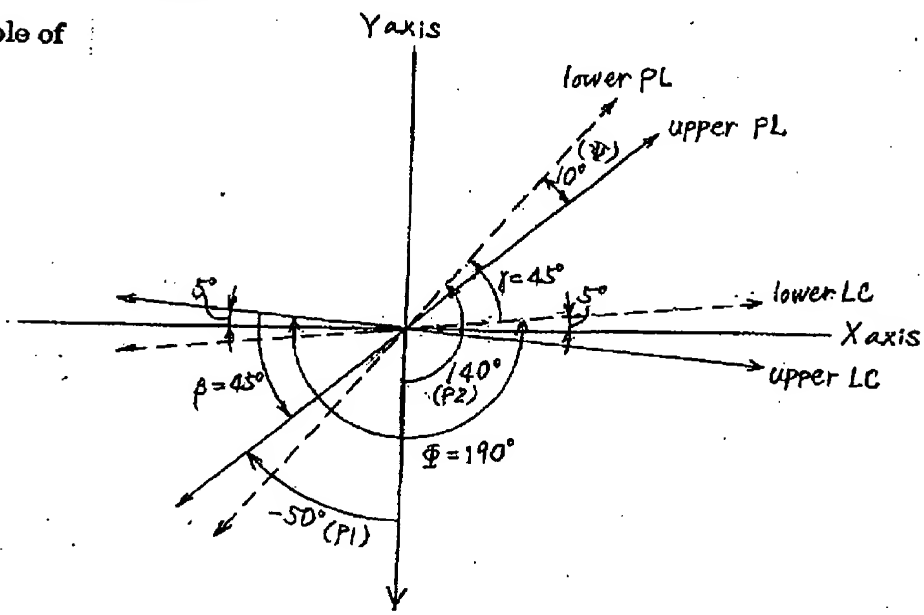
A direction in which intermediate liquid crystal molecules are oriented.

FIG. B

Modified Example of Amstutz 3

condition

$\Phi = 190°$
$\gamma = 45°$
$\beta = 45°$



A direction in which intermediate liquid crystal molecules are oriented